

**Application of Methods to be Employed by Dental Personnel and Others--Methods of  
Stopping/Reversing Disease: Behavior Modification**

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*Abstract:*

Models of self-regulation of patient adherence to specific health promotion recommendations by professionals are available and have been shown effective in changing behavior. However, it is a fundamental misspecification of the caries prevention problem to look to techniques that affect the regulation of individual behavior to directly impact dental caries. Behavioral techniques are used to enhance the probability an individual will initiate, increase, or maintain the use of established caries reduction/control strategies or cease or decrease behaviors that increase caries. Behavioral techniques can also be used to affect the regulation of parental behavior in a cascade of effects that can eventually lead to healthier children. Studies are needed where behaviorally oriented caries prevention actions are thought of as manipulating self-regulatory behavior and the focus of action is either on the individual; or alternatively on another, such as a parent. A third category of studies should center on provider competency. Studies are recommended in each of these areas.

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Models of self-regulation of patient adherence to specific health promotion recommendations by professionals are available and have been shown effective in changing behavior.<sup>1-3</sup> Kay and Locker recently reviewed this research literature in dentistry and found seven randomized trials, mostly involving school children, and a number of quasi-experimental studies involving tooth brushing with a fluoridated dentifrice.<sup>4</sup> They concluded that the interventions reduced the incidence of dental caries but ascribed the effect to the fluoride dentifrice rather than tooth brushing. They also concluded from the studies that the fluoridated toothpaste needed to be used daily. Hotz drew a similar conclusion based on a review of cross sectional studies.<sup>5</sup>

There have been a few, relatively unsophisticated, studies that examined similar behavioral techniques in the promotion of oral hygiene.<sup>4</sup> These studies came about during a period when the main focus of dental researchers was periodontal disease. The effects in these studies are also modest and short-term. Moreover, it is unclear whether reduction of plaque alone would result in caries control because tooth brushing may fail to control plaque at the surfaces at greatest risk. The major problem with the oral hygiene studies, however, is that the desired behaviors decrease in frequency when external reinforcement is withdrawn. This is often seen as evidence that the technique is not efficacious rather than simply a confirmation of the underlying theory that reinforcement is needed. Modest, short-term behavioral programs have resulted in short-term results.

Ramsay has argued that technological improvements, such as timers on electric toothbrushes and toothpaste tubes that beep if not opened every day, are based on sound theory and will increase adherence whether the behavioral issue aims at oral hygiene or delivering fluoride.<sup>6</sup> Similarly he has argued that if the toothpaste tube sends an automatic

email to the dentist when it is not opened, the health care provider can be more effective as an external change agent. This also could apply to feedback to a parent to increase the reinforcement of behavior with a child who brushes his/her own teeth. Based on the generic behavioral literature, more effective interventions can be designed and investigated.

However, it is a fundamental misspecification of the caries prevention problem to look to techniques that affect the regulation of individual behavior to directly impact dental caries. Behavioral techniques are used to enhance the probability an individual will initiate, increase or maintain the use of established caries reduction/control strategies or cease or decrease behaviors that increase caries.<sup>7</sup> Behavioral techniques also can be used to affect the regulation of parental behavior in a cascade of effects that can eventually lead to healthier children.<sup>8</sup>

Also it is a misspecification of the caries prevention problem to define the outcome in terms of visible tooth lesions, whether they be cavitated or not. This continues the fiction that the problem begins at this stage when it is only that our risk models and detection tools are inadequate to detect the problem at an earlier stage. For example, from a behavioral point of view a Native American, Hispanic or Alaskan Native newborn without teeth but with a mother with untreated caries and poor hygiene has dental caries already. The child has a high likelihood of being infected with caries causing organisms and a mother who is not likely to practice good oral hygiene.<sup>8</sup>

Studies are needed where behaviorally oriented caries prevention actions are thought of as manipulating self-regulatory behavior and the focus of action is either on the individual; or alternatively on another, such as a parent (Table 1). A third category of studies should

center on provider competency (Table 2). In this paper, examples of needed studies are given. Additional excellent recommendations are given elsewhere.<sup>9</sup>

## **SELF-REGULATORY BEHAVIOR**

The best understood example of self-regulatory behavior is tooth brushing with a fluoridated dentifrice. This behavior is well accepted by the public, largely because of industry advertising. There is little controversy about whether frequent professionally administered mechanical tooth cleaning along with a fluoride vehicle is effective in controlling caries.<sup>5</sup> A recent health education study with adolescents, using a randomized controlled design, demonstrated reductions of plaque levels over 12 months after lessons in tooth brushing with a fluoridated paste as well as increases in knowledge.<sup>10</sup> On the other hand, there is mixed evidence about the same activity when done by unsupervised individuals when one looks at all the teeth. This problem may rest in the argument that fluoride is ineffective in remineralization in the presence of large numbers of pH reducing plaque bacteria. None of this work has focused on the efficacy of tooth brushing with fluoride dentifrice on stopping or reversing disease. Nevertheless, evidence suggests that the problem with the at-home data is skill rather than performance deficits (caries control is seen in easy to brush front teeth). Studies are needed to specify the brushing time/effectiveness relationship relative to caries although there is a relationship between brushing time and plaque removal in children and adults.

Studies to initiate, increase, or maintain tooth brushing with a fluoridated dentifrice will fail to demonstrate the effectiveness of caries control if the underlying efficacy of the tooth brushing/fluoride dentifrice intervention is not clear or if the problem is described as a

performance (frequency per day or time/brushing episode) problem rather than a skill (quality of brushing) problem.<sup>7</sup>

A second example is chewing gum. There are several human trials suggesting dose related reductions in caries rates when xylitol chewing gum is used.<sup>11</sup> Hildebrant and colleagues also recently reported on the maintenance of Mutans streptococci suppression using xylitol gum following a period of rinsing with chlorhexidine.<sup>12</sup> Nevertheless much valid controversy exists about the interpretation of the field trials and the proposed mechanism of action of xylitol. Behaviorists will be reluctant to develop studies to test the effectiveness of chewing gum if controversy exists as to its efficaciousness. Moreover, scientists will be reluctant to develop alternative xylitol vehicles, such as foods that might be used in sponsored meal programs in public schools, in the presence of controversy.

### **SELF-REGULATORY BEHAVIOR: FOCUS ON ANOTHER**

An example of this problem is having the parent brush a preschool child's teeth with or without a fluoridated dentifrice. Studies are needed that focus on the efficacy and effectiveness of the behavior although it is widely accepted and recommended. Studies do not exist that clearly demonstrate the frequency-response relationship or even the optimal time of day for the behaviors, if indeed timing matters. Public health officials are in fact sending a message that overuse of fluoridated dentifrice results in unacceptable levels of fluorosis. A behaviorist can construct a strategy to help a parent regulate his/her behavior and these strategies can be tested but such studies are confounded if the underlying efficacy of the caries control strategy is in question.

A second example is that of feeding habits and caries. Professionals are convinced that taking away night and naptime bottles and weaning at one year are effective strategies in controlling early childhood caries. Yet the evidence for these statements is primarily cross-sectional and retrospective. Prospective studies are needed. Moreover, efforts to change this one behavior are likely to have ramifications for the remainder of the diet. Researchers who ask behavioral strategists to develop studies that promote adherence to this professional recommendation need to have shown that the strategy is efficacious and that is not countermanded by other changes in the diet.

A third example is illustrated by a study where health visitors were used to promote behaviors to reduce “nursing caries.”<sup>13</sup> Among the behaviors encouraged in this simple health education intervention was registering the baby with a dentist. Improvements were seen over baseline for recall of the need to register the child, and actual visit behaviors were increased for a related activity, coming in for hearing checks. The study itself is limited and doesn’t allow generalization; nevertheless, it is a good example of the broader perspective needed to address the role of behavior and caries.

A final example relates to the mother’s experience with dental care. Starfield has assembled evidence that having a usual source of medical care improves satisfaction, adherence with professional recommendations and outcomes.<sup>14</sup> We have shown that low-income mothers are less likely to take their child to the dentist if they are afraid of the dentist.<sup>15</sup> This behavior is critical because dentists are the main source of knowledge for mothers about oral health promotion messages for their children. Moreover, caries is transmissible and the mother, who may herself be in poor oral health, is both the source of oral bacteria and oral habits for the child. Studies are needed to show that mothers with a

usual source of dental care are more adherent regarding professional recommendations and have healthier children.<sup>16</sup> However, there are studies that suggest that mothers in better oral health will have children with lower levels of cariogenic bacteria. Studies are needed on how to overcome barriers, for example in the Medicaid program, where pregnant women and mothers receive poorer benefits than their children do.

## **COMPETENCY OF HEALTH CARE WORKERS**

A third area of promising new research directions for the prevention and treatment of dental caries relates to the competency of health care workers. Evidence suggests that the adoption of new technologies and strategies by health care workers follows predictable paths and can be influenced. Further reports in the literature suggest that efforts to develop and evaluate the adoption of innovations in dentistry could result in increased competency of dental care workers and greater availability of preventive strategies.<sup>17-19</sup>

Weinstein and colleagues, for example, are conducting a study using motivational interviewing (MI) techniques to impact the behavior of pregnant women and new mothers relative to oral health.<sup>20</sup> MI is a client-centered but directive counseling approach that is especially useful when an individual is ambivalent. It has been used to change addictive behaviors and in pain management as well as in other areas of health care. This current study uses peer counselors and offers mothers alternative strategies to prevent/control early childhood caries. Examples are reducing dietary sugar, weaning children by one year of age, and taking the child to the dentist for fluoride treatments. The investigators have developed a highly structured training manual and monitoring system to enhance the competence of the

health care providers. However, the effectiveness of the intervention relative to early childhood caries remains to be evaluated.

Second, Grembowski and colleagues are conducting a study in which a dental prepayment plan is offering financial incentives and continuing education to dentists to use strategies such as fluoride varnish to prevent secondary caries and prolong the lifetime of restorations.<sup>21</sup> Again, the evidence for the efficacy of the individual strategies recommended is weaker than one would suppose and the behavioral intervention with dentists may be effective (increase the frequency of preventive services provided) yet not improve health. Also, the design includes a number of intervention steps (for example, both continuing education and feedback about services provided) and the investigators are unlikely to be able to tease out what aspects of the intervention are more or less effective.

Finally, Lewis and colleagues are studying the role of pediatricians in oral health anticipatory guidance and fluoride treatments for children.<sup>22</sup> In a survey of 1400 pediatricians nationwide they postulated a model of factors governing whether a pediatrician would be willing to apply topical fluorides to his/her patients. The results suggest that seeing caries regularly in practice and familiarity with available modalities are related to physician willingness to engage in this preventive dental behavior. Thus research aimed at increasing pediatrician awareness of dental caries and available prevention strategies may result in behaviors that directly or indirectly impact dental caries. In related work, the investigators raise the question of the efficacy of fluoride supplements for children (CW Lewis, personal communication). They note the lack of agreement among dental experts; and thus, are reluctant to say whether the use of behavioral strategies to increase this behavior should be

pursued. Nevertheless, behavioral studies to develop and evaluate interventions with physicians and other health care workers.

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**Table 1. Examples self-regulatory behavior where the action is on another**

- Initiate or increase or maintain a parent's frequency of brushing a child's teeth with a fluoridated dentifrice or initiate brushing twice daily
- Increase or maintain the quality of a parent's brushing of a child's teeth
- Reduce the frequency of a child's refined carbohydrate snacks
- Reduce the frequency of short bottle or breast-feeding episodes in the diet, especially at naps or at night.
- Weaning a child at one year, either cold turkey or gradually.
- The relationship between a mother having a usual source of humane preventive dental care, and receiving preventively oriented care and taking the child to the dentist.

**Table 2. Examples of health promotion aimed at professional competency**

- Improve the teaching and reinforcement of the skill component of oral hygiene
- Increase the amount of time devoted to teaching and reinforcement of oral hygiene
- Learn to offer alternative strategies to individual patients and parents to control disease and estimate their potential effectiveness
- Reduce the fear/pain causing behaviors of dental personnel that result in reduced compliance with preventive visits
- Increase anticipatory guidance by public health nurses, family doctors and pediatricians.